

Habitat & Wildlife Management

A Natural Areas Inventory of the City of Virginia Beach

This three-year inventory systematically identified the city's natural heritage resources. A natural heritage resource is defined as "the habitats of rare, threatened, or endangered plant and animal species, rare or state significant natural communities or geologic sites, and similar features of scientific interest" (VA Natural Area Preserves Act, 10.1-209 et seq. of the Code of Virginia). An initial contract between the City of Virginia Beach and the Department of Conservation and Recreation, Division of Natural Heritage (DCR- DNH), involved the collection and synthesis of existing information and preparation for field study, including the identification of areas that include unique or exemplary natural habitats.

Phase II of the natural areas inventory, funded by the Virginia Coastal Program, involved a field inventory, including the production of a series of topographic maps containing information on species occurrence and a complete listing of species ranked as endangered on a state, federal and global level. The Phase I report includes an overview of the study area, and a description of the methods used by DCR-DNH to conduct the field inventory. Results include a list of potential natural areas and an accompanying map; a summary of work completed to date; a list of natural heritage resources identified in the city; and a map showing locations of natural heritage resources as of September 1991.

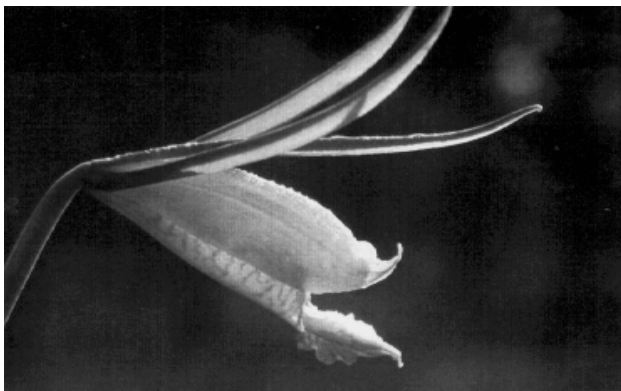


Photo by Hal Horowitz

Spreading pogonia (*Cleistes divaricata*), known in Virginia Beach only from the North Pocosin Natural Area.

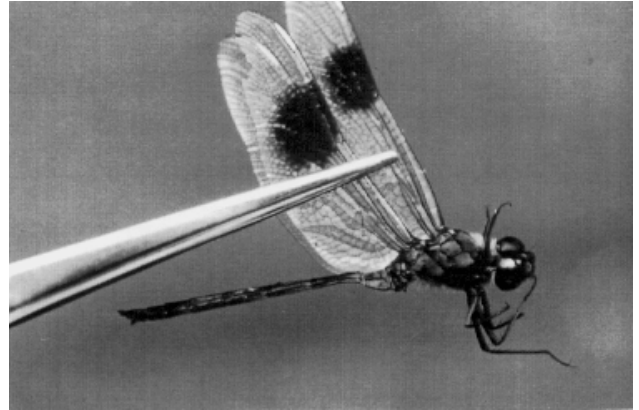


Photo by Kurt Buhlmann

The damselfly, or Four-spotted pennant (*Brachymesia gravida*), known in Virginia Beach from Seashore and False Cape State Parks.

In Phase III of this study, 23 natural areas were found to support natural heritage resources, including 20 rare vertebrate species, 39 rare invertebrate species, and 76 rare plant species. The delineation of conservation boundaries in this report are intended to be used to support wise planning and decision-making within the City.

The Phase IV report documents conservation planning for management and protection of natural areas identified in the natural areas inventory undertaken by the city and DCR-DNH in 1991 and 1992, and completed in March of 1993. New data collected were combined with existing knowledge from earlier inventory work to produce conservation boundaries for each natural area, including a site description, current status/ownership/use/zoning, recreational/scenic/educational considerations, and guidelines for protection of these particular areas. In addition, conservation boundaries were digitized for integration into the city's GIS. This report is currently being used as a reference by the city during review of city development plans, long-range planning, and development of a city conservation strategy.

*Virginia Department of Conservation and Recreation/
City of Virginia Beach*

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November 1991, March 1993, June 1994

1990 Task 68, 1991 Task 70, 1992 Task 62



Habitat & Wildlife Management

Conservation Planning for the Natural Areas of the Lower Peninsula of Virginia

This three-year inventory, conducted by the Department of Conservation and Recreation, Division of Natural Heritage, systematically identified the remaining natural areas of the City of Williamsburg, James City County, and York County. An overview of the geology and the existing natural vegetation of the lower peninsula was presented in the January 1992 report. The methods of the study are outlined and the results of the inventories are discussed. The natural areas identified during this study are described and future actions, including protection measures, are introduced.

In the March 1993 report, seven rare vertebrate species, ten rare invertebrate species, and forty-five rare plant species from the three localities are recorded. The information provided will facilitate well-informed planning and wise land use decisions by the local governments. The report is also being used to increase the awareness of local officials and residents of regional biodiversity issues, and to assist local conservation organizations in their land protection and environmental education efforts.

Virginia Department of Conservation and Recreation

Contact: Ken Clark, 804.786.7951

January 1992, March 1993

1990 Task 71, 1991 Task 10



Photo by Christopher Pague

Barking Tree Frog (*Hyla gratiosa*). York County.



Photo by Richard H. Wiegand

Virginia least trillium (*Trillium pusillum* var. *virginianum*). James City County.

Conservation Planning for the Management and Protection of Natural Areas in the Albemarle-Pamlico Estuary

This plan, produced by the Division of Natural Heritage at the Department of Conservation and Recreation, facilitates improved natural area protection and management of the Virginia portion of the Albemarle-Pamlico Estuary by providing comprehensive information and guidance for the region. Fifty-seven sites were initially documented, with 11 natural areas and two natural area macrosites chosen for detailed study. Objectives included 1) development of natural area protection boundaries, 2) development of natural area management and protection strategies, 3) natural area landowner contact and education, and 4) implementation of site protection mechanisms. By combining new data with existing knowledge, each area is now defined by detailed description and refined boundaries, level of biodiversity, status and use of each site, ownership, and zoning. Landowner contact was an important component of this study, and the report contains a useful flowchart of the process used.

Virginia Department of Conservation and Recreation

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March 1994

1992 Task 16



Habitat & Wildlife Management

Natural Area Source Book and Sample Natural Area Management Plans

Virginia's Coastal Resource Management Area is rich in biodiversity. At least 65 natural areas are found in public or private conservation ownership, and managed for their biodiversity and inherent natural values. The Virginia Department of Conservation & Recreation, Division of Natural Heritage, has produced a **Natural Area Source Book** and a model resource management plan for two natural areas within the coastal zone, North Landing River and Bethel Beach Natural Area Preserves. Both the source books and the resource management plans are designed to assist land managers, conservation planners, and resource experts with land stewardship.

An interdisciplinary team of resource managers, scientists, and planners, knowledgeable regarding specific resources and management techniques, contributed to the production of these **Natural Area Source Books** and resource management plans. Each source book provides valuable information about the location of the natural area within the coastal zone; highlights opportunities for education and research; and includes a comprehensive guide to agencies, organizations, academic institutions, and individuals knowledgeable regarding natural area management and conservation issues; an extensive bibliography; and guide to resource management planning.

Virginia Department of Conservation & Recreation

Contact: Sandra Erdle, 804.786.7951

March 1995

1993 Task 10

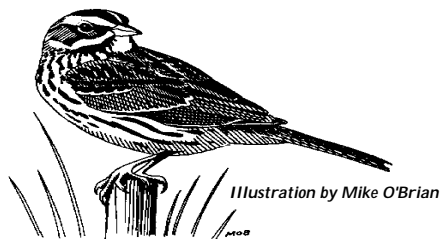


Illustration by Mike O'Brian

Habitat & Wildlife Management

Intertidal Oyster Reefs as a Tool for Estuarine Rehabilitation & Rejuvenation

The oyster resources of the Chesapeake Bay have been in a state of continuing decline for at least the past century. The combined effects of harvesting, disease and environmental degradation have all but removed the three-dimensional structure of oyster reefs which evolved in the Bay over the past 10,000 years and which were present when colonial settlement began. This project examined the option to rejuvenate local oyster stocks in a relatively pristine location, the Piankatank River, by providing intertidal oyster reefs with distinct three-dimensional topography, the like of which has been absent from the Bay for decades.

The project began in May of 1993 with construction of a reef on the footprint of a formerly productive natural reef. The reef was not seeded with oysters due to the desire to colonize the reef only from natural larval settlement, avoiding potential addition of adult oysters carrying endemic diseases. Despite short oyster settlement seasons in the summers of 1993 and 1994, oyster settlement and growth were observed at all tidal levels on the reef. Of particular interest, was the finding that oysters settle extensively within the matrix of the reef structure, up to 10 cm below the reef surface; and that these locations form refuges from predation or environmental extremes, allowing oysters to survive and grow rapidly. Individual oysters grew to over 60 mm in length over the summer of 1993 and 1994.

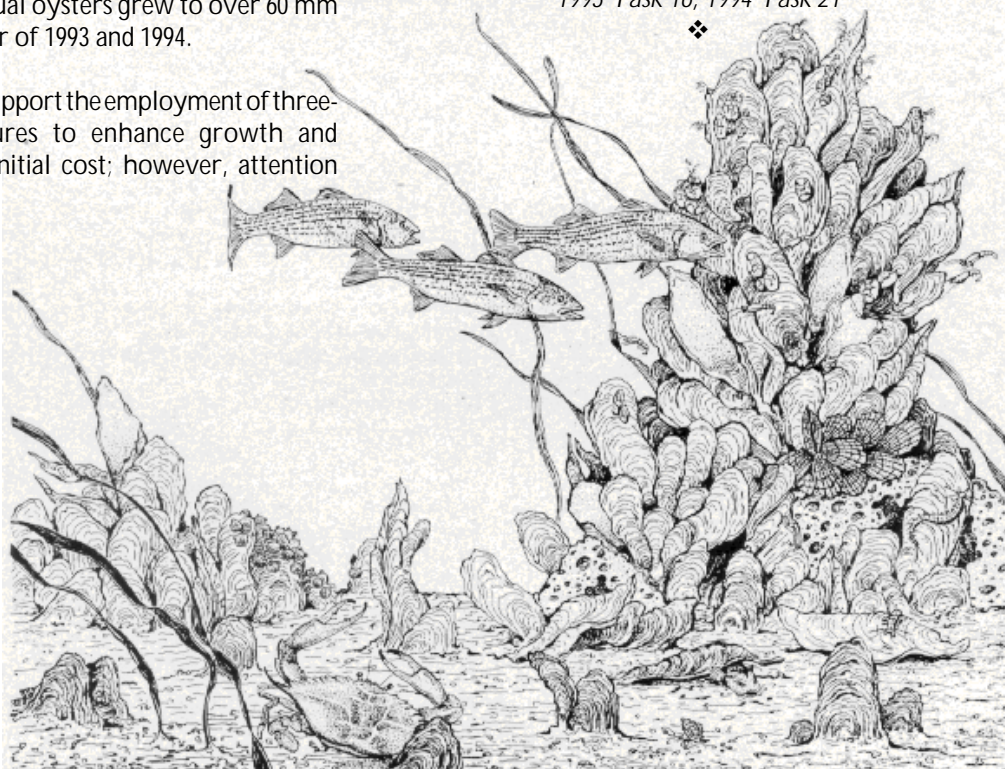
The August 1996 findings support the employment of three-dimensional reef structures to enhance growth and settlement despite their initial cost; however, attention

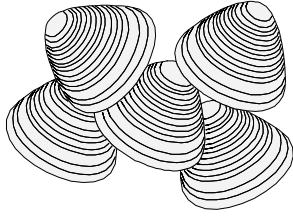
should be paid to micro scale changes in biology when building reefs. The ability of oysters to thrive within the matrix of the reef structure suggests that constructed reefs must have minimal thickness of overlaying shell veneer to optimize survival and growth.

With 1994 funds, this project continued to examine the biological value of intertidal, three-dimensional oyster reefs. Cumulative settlement of oysters in the study area over the summers of 1993-1995 has resulted in densities of oysters comparable with the extant oyster reefs in productive regions of the James River and the seaside of the Eastern Shore of Virginia.

Development of oyster populations and associated fish and invertebrate communities continue to encourage the employment of reefs to rebuild oyster stocks; however, such stocks are not immune from endemic diseases. By the end of the summer of 1995 *Perkinsus marinus*, commonly known as "Dermo" disease, was present at all tidal levels of the reef and associated mortalities were observed. Reefs can form concentrated populations of oysters which have beneficial value as spawning sanctuaries, but their value for increasing longevity of the individual oysters is probably limited.

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August 1996
1993 Task 16, 1994 Task 21*



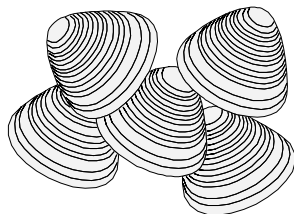


Fishery Independent Stock Assessment of Virginia's Hard Clams Population of the Chesapeake Bay

The hard clam (*Mercenaria mercenaria*) is one of the most important commercial species harvested in Virginia's Bay waters. As the oyster and other commercially harvested species have declined, a portion of the displaced workforce has joined the clamming fleet. Declining catches have raised concern for both watermen and fishery managers; however, little current information was available for either hard clam standing stock levels or age structure.

The current project used a fishery-independent stock assessment method using a hydraulic patent tong sampling device to survey hard clams in the James River-Hampton Roads area. When compared with results from previous stock assessment estimates in this area, the current clam densities and standing stocks were not obviously different. Age and size structure, however, has changed since earlier studies, with less larger and older clams in the current population. Declines in the commercial clammer's catch per day may be explained by a decrease of population in many once high density clam areas over the many years of fishing in a number of high density clam areas. Today's clam populations may be more uniformly distributed, resulting in the individual clammer catching fewer clams per day due to a limit on the number of daily tong grabs, and fewer clams in each tong grab made.

Virginia Marine Resources Commission
Contact: James Wesson, 757.247.2121
June 1995
1993 Task 26



Shellfish Habitat Restoration Through Remediation of Nonpoint Fecal Coliform

The purpose of this research project was to identify and explain nonpoint fecal coliform sources (i.e., *Escherichia coli* = *E. coli*) to tidal inlets using a combination of field and laboratory (molecular biology) techniques. Field biology techniques involved "tracking" elevated fecal coliform signals to their source and using a variety of observations to identify potential sources and recommend specific remediation. Molecular biology techniques relied on Restriction Endonuclease Digestion Profiles (DNA fingerprints) of *E. coli* samples of animals from known sources, e.g. deer, raccoon, otter and muskrat. The accumulation of fingerprinting patterns resulted in the development of a DNA Library, a DNA dichotomous key, and a library of Descriptions for the known strains.

To date, this research indicates that using field and laboratory methods, alone or in combination, provides a very high likelihood that nonpoint fecal coliform sources can be identified and remediated to improve water quality. According to the Department of Health, there has been a 55% increase in the number of acres condemned over the past decade for shellfish harvest in Virginia since 1970. Field tracking techniques alone have been highly successful in identifying the sources of nonpoint fecal coliform threatening the closure of shellfish areas. As a result, nearly 100 acres of previously condemned shellfish grounds have been reopened.

The DNA library has been challenged with a series of unknowns from several localities in the southern Chesapeake Bay. Of the 88 *E. coli* strains from unknown sources that were fingerprinted, 58 strains (66%) resulted in some degree of identification with known sources. Twenty-two strains (25% of the strains tested) resulted in identification with known strains in the library. Only eight strains suggest a human source. This is very significant considering that just a couple of years ago such identification seemed virtually impossible. The present scope of the DNA Library is modest (240 strains). Continued water quality remediation benefits will depend on the continued acquisition of *E. coli* strains from known sources, specifically *E. coli* strains from domestic animals whose fecal material can interact with tidal waters through stormwater runoff.

Virginia Polytechnic & State University
Contact: George Simmons, 540.231.6407
February 1997
1995 Task 23



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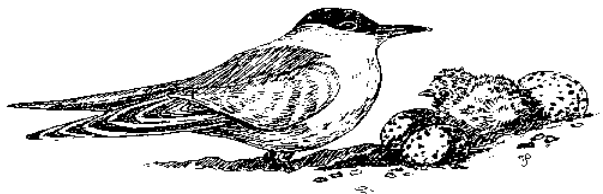


Illustration by Thelma Peterson

Conservation Action Plan for the Avian Communities of the Virginia Barrier Islands

The Virginia barrier islands system has long been renowned for hosting large numbers of nesting, migrating and wintering colonial waterbirds, waterfowl, shorebirds, raptors, and songbirds. This system includes the barrier islands, the coastal bays and salt marshes, and the mainland and associated marshes. It has experienced far less human disturbance than any other barrier island-salt marsh system on the Atlantic coast.

The dynamic nature of the area makes it a unique and flourishing habitat for many of the avian species that are found here, but it also makes them much more subject to disturbances, both natural and human in origin. Numerous protection efforts have been initiated, including the establishment of refuges by federal, state, and private conservation groups. Virginia's barrier islands system has been designated as a "Man and the Biosphere Reserve" by the United Nations and by the Western Hemisphere Shorebird Reserve Network through its designation as an "International Shorebird Reserve." The Virginia Coast Reserve, a preserve of 14 islands under protection of The Nature Conservancy, has been designated as one of its "Last Great Places."

Although these efforts have gone a long way toward protecting this important natural resource, many threats place the avian communities in jeopardy. Threats include habitat loss and degradation, severe weather events, competition, predation, disease, contamination, disturbance, and water quality decline. This **Conservation Action Plan** addresses these threats and contains information on the status and trends of the avian communities in the barrier island system. It offers a menu of recommendations for potential actions in management, research, monitoring, and education that have been evaluated in terms of priority, feasibility, costs, partnerships, and measurability. The goal of the Conservation Action Plan is *to ensure the long-term viability of the avian communities, species, and habitats in the Virginia barrier islands system through a partnership approach.*

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September 1996
1993 Task 28*



Illustration by M. Urbi Watts

Habitat & Wildlife Management

Assessment of the Habitat Function of Tidal Wetlands for Rare, Threatened and Endangered Nesting Bird Communities in Virginia

Coastal surveys of Virginia's rare, threatened and endangered bird species were conducted. Literature review and field surveys were used to determine and describe habitat requirements of avian species which occur in wetlands in the coastal plain of Virginia. Information learned from these studies was applied to existing wetlands inventories in order to evaluate the function and value of these wetlands as wildlife habitat. The study determined that wetland or salt marsh size, or area, is a key factor in the incidence, abundance and species richness of marsh bird species. Area sensitivity was investigated by comparison of bird population densities in wetlands of different sizes which are otherwise similar in habitat characteristics such as plant community comparison. The implications of area sensitivity on the assessment of impacts of shoreline structures was explored.

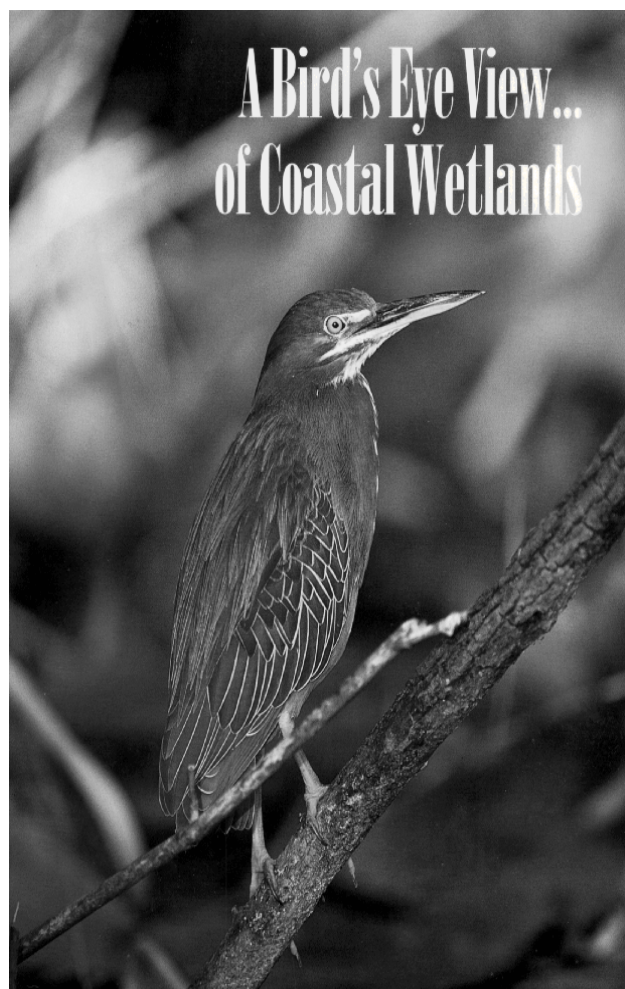
This information is valuable to agencies and individuals involved in a coordinated, proactive conservation strategy of these species in Virginia. Accurate, up-to-date information is important for purposes of permitting and sound land use planning. A cutting edge methodology for assessing habitat, size, and spatial use of marshes was developed and tested. A final report entitled **Effects of Marsh Size on Incidence Rates and Avian Community Organization within the Lower Chesapeake Bay** was published.

A special issue of Virginia Wildlife magazine, **A Bird's Eye View ... of Coastal Wetlands**, were also published. Copies of this article was distributed to all county planners, wetlands boards, other local, state, and federal agencies, and the public.

*Virginia Department of Game and Inland Fisheries
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November 1993

1992 Task 15



*The lives of at least 150 species of birds living in the Chesapeake Bay are bound to the health and complexity of our coastal wetlands. The more we learn, the more we realize how easily our actions can threaten their survival.
(A Bird's Eye View...of Coastal Wetlands)*

Habitat & Wildlife Management

Production and Implementation of a Habitat Suitability Model for Breeding Bald Eagles in the Lower Chesapeake Bay

Historically the Bald Eagle was a common breeder along major river systems. Breeding populations were decimated in the 1960s by pesticides, but have been showing signs of recovery due to pesticide bans. The Bald Eagle is now, however, threatened by habitat loss due to urbanization. This project, implemented in two phases, first develops a breeding habitat model for use in delineating potential breeding areas, then as a tool to identify critical habitat areas. The model uses 80 macrohabitat variables divided among four categories, including: topography, land use, habitat/vegetation, and human disturbance. Limiting factors developed from descriptive statistics are used to delineate and map the distribution of unusable and potential breeding habitat. Localities may use this information to steer land development in a direction conducive to eagle conservation.

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January 1994
1992 Task 14*



The Bald Eagle of Virginia: An Information Booklet for Land Planners and Managers

This document is for local and regional land planners and managers, and regulatory agencies. Two versions of this document were produced. The first is a full copy of all county maps and with potential breeding habitat. This collection of maps is intended to give regional planners a quick reference to all known eagle activity areas in the Coastal Plain. The second version is tailored to each individual county, and contains only the maps that pertain to that county. Habitat delineation maps were not produced for areas outside of the James and Rappahannock river corridors.

*College of William & Mary,
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June 1994
1992 Task 2.4*



*See Also: Public Education, page 71:
The Bald Eagle of Virginia: A Management Guide for
Landowners*

Source: The Bald Eagle of Virginia - An Information Booklet for Land Planners and Managers

Habitat & Wildlife Management

Monitoring Avian Migration at Kiptopeke State Park

For more than 18 years the Kiptopeke Hawkwatch has been conducted by volunteers at what is now Kiptopeke State Park. During the fall of 1995, at the request of the Kiptopeke Environmental Station Research Education Laboratory (KESTREL Foundation), the first full-time hawk count was taken by a single trained observer. From August 15 to November 30, 1995 a total of 79,208 raptors of seventeen species were recorded during 966.5 hours of observation. In 1996, a total of 69,118 raptors were counted and recorded during 966.5 hours of observation between September 14 and November 30. Counts are conducted on a daily basis, except when precipitation or unfavorable winds were prevalent.

This project also supported an intern who served at the Passerine Banding Station at the Park, and provided regular and impromptu public information talks and demonstrations on the dynamics of passerine migration. Between September 1 and October 25, 1996, seven banders spent 651 hours during 52 days of operation banding 3360 birds of 83 species. These numbers were down from 1995 by 22% (3801) and 6% (88) in 1994. Hatching year and young of the year make up 87% of the birds handled. Six species of warblers are among the ten most commonly trapped birds.

Source: 1997 Kiptopeke Banding Station Report.

More than 270 species of birds are recorded on the peninsula each fall. The purpose of these observations is to gather long-term data regarding the fall migration of raptors and migratory songbirds along the Atlantic Flyway of Virginia's Eastern Shore. This information is essential to the development of sound, comprehensive regional, national and international management plans. By establishing a long-term census project, populations and migratory trends can be assessed and monitored. The secondary purpose of the project is to provide public education concerning raptors and migratory songbirds, their migration, and usage of vital habitat found along the Eastern Shore. A report is available which provides a detailed summary and analysis of the 1995 and 1996 hawk counts and captures, and passerine banding results.

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January 1996, February 1997
1994 Task 2.10, 1995 Task 2.4*



Source: 1996 Cape Charles Raptor Research Station Annual Report

Habitat & Wildlife Management



Artwork by Doreen Curtin

The Neotropical Migratory Songbird Coastal Corridor Study: Special Virginia Edition

Repeated accounts of population declines for many neotropical migratory songbird species have awakened widespread concern and sparked national and international conservation initiatives. These birds, which summer in the northeastern U.S., "hopscotch" down the Atlantic coast each fall on their way to their winter grounds in the tropics. Two of the major "stopover areas" are the tip of Virginia's Eastern Shore and Cape May, New Jersey.

In the fall of 1991, this study examined the distribution and habitat associations of fall migrating land birds within the coastal regions of New Jersey, Delaware, Maryland and Virginia. The Virginia Coastal Program brought together The Nature Conservancy and each state's Natural Heritage Program to conduct the study. Each weekend, hundreds of volunteers counted birds across transects in the four state region. There were 487 survey sites and 12,000 point counts conducted August through October, resulting in a count of over 36,000 birds of 91 species.

The final report contains data tables as well as extensive recommendations for land managers and private landowners from a regional and state perspective. It also suggests native trees, shrubs and vines to be used in landscaping that would benefit the songbirds. Native plants, particularly dense understory shrubs, provide critical food cover during the stressful period of fall migration when birds need to store energy for their long flight. In addition, the Special Virginia Edition of the report contains a preliminary natural areas survey of Northampton and Accomack Counties.

Virginia Coastal Program

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August 1993

1990 Section 309 Interstate Award



Conservation Plan for Marine Mammals and Sea Turtles in Virginia

This project developed a comprehensive plan to conserve sea turtles and marine mammals in Virginia. The plan represents a cooperative private/public effort to identify, prioritize, and implement those steps necessary to conserve these species in Virginia. Team members included representatives from Virginia state agencies, federal agencies, educational institutions, and conservation groups. The plan focuses on the most commonly occurring species of marine mammals and sea turtles in Virginia, but encompasses all 35 species that have been recorded as live or stranded, since they share common life history and habitat needs while in Virginia waters. This includes five species of sea turtles and 30 species of marine mammals, 13 of these imperiled. VMRC, DGIF, VIMS, the U.S. Fish & Wildlife Service, and the National Marine Fisheries Service share responsibility for the protection and management of sea turtles and marine mammals in Virginia.

The four objectives of the plan are: 1) Protect, manage, and enhance sea turtle and marine mammal populations by assessing population status and trends as well as the life history needs of these species utilizing Virginia's waters. 2) Protect, manage, and enhance the habitats of sea turtles and marine mammals by identifying, documenting, and then minimizing impacts to their habitats and populations. 3) Identify and coordinate existing roles, responsibilities, and activities of the various parties and promote improved coordination. 4) Improve and promote education and public participation.

VIMS' and VDGIF's published article—**Swimming Beyond Boundaries: The Uncertain Future of Virginia's Marine Mammals and Sea Turtles**, *Virginia Wildlife*, January 1994—summarizes the results of the first phase of this project. Essential baseline status information was summarized and the group identified gaps in the data, such as seasonal distribution, abundance, and habitat utilization of sea turtles and mammals in the Chesapeake Bay and coastal waters. This article fulfilled the groups' goal to disseminate information learned and developed throughout the effort. A companion video was also produced.

Virginia Institute for Marine Science/Virginia Department of Game and Inland Fisheries

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January 1994

1993 Task 14



Habitat & Wildlife Management

Distribution of the Atlantic Bottlenose Dolphin in Virginia Tidal Rivers

This pilot project used volunteer networks to collect information on bottlenose dolphin (*Tursiops truncatus*) distribution from May through October in Chesapeake Bay tributary rivers (James, York, Piankatank, Rappahannock, Potomac) and the Eastern Shore. The primary observers were volunteer water quality monitors with the Alliance for the Chesapeake Bay. Volunteers were trained in survey protocol and given maps to plot dolphin sightings. Two aerial surveys were conducted to provide more complete coverage of Chesapeake Bay and river mouth shorelines.

Results of volunteer observations and aerial survey sightings were plotted using GIS. The total number of dolphins sighted ranged from 350-596 with a best estimate of 505. Despite difficulties calculating effort, the sighting data provide the first riverine bottlenose sightings recorded by trained observers in Virginia. A Bottlenose Dolphin Sightings Home Page has been designed by the Virginia Chesapeake Bay National Research Reserve (<http://www.vims.edu/cbnerr/teach/dolphome.htm>) which includes information from the study.

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February 1997
1994 Task 2.12*



Sighting Patterns of Coastal Migratory Bottlenose Dolphins in the Near Shore Waters of Virginia and North Carolina

The Virginia Marine Science Museum conducted a dolphin photo-identification and migration study in cooperation with researchers in North Carolina. Bottlenose dolphins (*Tursiops truncatus*) are considered depleted under the Marine Mammal Protection Act of 1994. These coastal migratory dolphins are only present for part of the year north of Cape Hatteras, occurring in the highest concentration on Virginia's coast in Virginia Beach from April to November. Dolphins in North Carolina are present year round south of Cape Hatteras.

Photo-identification is a technique that takes a "dorsal fin-print" of individual animals which aids researchers in identifying and tracking recognizable dolphins over time. Researchers from Virginia and North Carolina compared photographs of dolphins' dorsal fins taken in both states. Individuals were identified and matched. The resulting evidence supported the theory of relatively discrete migratory populations whose ranges overlap spatially but not temporally.

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November 1996
1994, Task 77*



Habitat & Wildlife Management

Management and Conservation of Sea Turtles in Virginia

The sea turtle research program at the Virginia Institute of Marine Science (VIMS) has served as the National Marine Fisheries Service Sea Turtle Salvage and Stranding Network (STSSN) for Virginia since 1979. As such, the VIMS program has in place an organized state stranding network comprised of about 100 cooperating individuals and agencies. When possible, dead stranded sea turtles are identified, measured, weighed, and examined externally for tags, unusual markings, and cause of death. Currently all sea turtle stranding data are collected and summarized by VIMS and data are analyzed for species composition and age class in the Chesapeake Bay, cause of death, and location of strandings. Any unusual stranding events are monitored and reported to NMFS. The project's final report contains bar graphs showing totals of strandings of dead sea turtles per month for Virginia in 1996, the length frequency of these turtles, and maps illustrating the location of sea turtle strandings in 1996. A total of 195 dead sea turtles were recorded in Virginia in 1996, including 176 loggerheads, 8 Kemp's ridleys, 5 leatherbacks, and 3 green sea turtles, and 3 turtles that were unidentifiable. Of the 195 dead sea turtles, 12 fatalities were from propeller wounds, 3 from gunshot wounds, 2 from net/fishing line entanglement and the remaining 178 fatalities were from unknown causes. During 1996, 2 sick loggerheads and 1 sick Kemp's ridley were treated, and only one was successfully rehabilitated. The two fatalities were caused by severe propeller wounds. Juvenile turtles from Virginia's waters are important to the continued existence of the species, as they will be recruited into the breeding population over the next few years.

*Virginia Institute of Marine Science
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February 1997
1994 Task 26*



See Also:

Environmental Management, page 16
*Mapping Distribution & Abundance of Sub-Aquatic
Vegetation in the Chesapeake Bay and Virginia Tributaries*
Special Area Management Plans, page 87:
*Migratory Bird Habitat Public Education & Policy
Development*
Special Area Management Plans, page 88:
*Northampton County Migratory Bird Habitat Utilization
Study*
Special Area Management Plans, page 88:
Barrier Island and Marsh Nesting Waterbird Survey